

- New flow management standard, temperature management plan, additional technological fixes to temperature control structures, and long-term fish passage above Folsom Dam for steelhead on the American River;
- New minimum flow regime for steelhead in the Stanislaus River and long-term fish passage evaluations above Goodwin, Tulloch, and New Melones Dam; and
- A hatchery genetics management plan for Nimbus Hatchery for steelhead and fall-run Chinook salmon (which is an important prey base for listed Southern Resident DPS killer whale).

For more information, the 2009 NMFS BiOp can be found at:

[http://www.westcoast.fisheries.noaa.gov/publications/Central\\_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs\\_biological\\_and\\_conference\\_opinion\\_on\\_the\\_long-term\\_operations\\_of\\_the\\_cvp\\_and\\_swp.pdf](http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs_biological_and_conference_opinion_on_the_long-term_operations_of_the_cvp_and_swp.pdf).

## **Existing Water Facilities**

Below is a summary of the existing CVP and SWP water facilities. For additional information on CVP and SWP water service contracts, allocations, deliveries, and project facilities operational considerations that the SWP and CVP are obligated to comply with, see the Service 2008 and NMFS 2009 BiOps.

### *Central Valley Project (CVP) Re-authorization*

The CVP is the largest Federal Reclamation project and was originally authorized by the Rivers and Harbors Act of 1935. The CVP was reauthorized by the Rivers and Harbors Act of 1937 for the purposes of “improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of the stored waters thereof, for construction under the provisions of the Federal Reclamation Laws of such distribution systems as the Secretary of the Interior (Secretary) deems necessary in connection with lands for which said stored waters are to be delivered, for the reclamation of arid and semiarid lands and lands of Indian reservations, and other beneficial uses, and for the generation and sale of electric energy as a means of financially aiding and assisting such undertakings and in order to permit the full utilization of the works constructed.” This Act provided that the dams and reservoirs of the CVP “shall be used, first, for river regulation, improvement of navigation and flood control; second, for irrigation and domestic uses; and, third, for power.” The CVP was reauthorized in 1992 through the Central Valley Project Improvement Act (CVPIA) (Public Law 102-575, Title 34) adding mitigation, protection, and restoration of fish and wildlife as a project purpose. Further, the CVPIA specified that the dams and reservoirs of the CVP should now be used “first, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and fish and wildlife mitigation, protection and restoration purposes; and, third, for power and fish and wildlife enhancement.”

The CVPIA includes actions to benefit fish and wildlife. Specifically, Section 3406(b)(1) is implemented through the Anadromous Fish Restoration Program (AFRP). The AFRP objectives, as they relate to operations, are further explained below. CVPIA Section 3406(b)(1) provides for

modification of the CVP operations to meet the fishery restoration goals of the CVPIA, so long as the operations are not in conflict with the fulfillment of the Secretary's contractual obligations to provide CVP water for other authorized purposes. The DOI decision on Implementation of Section 3406(b)(2) of the CVPIA, dated May 9, 2003, provides for the dedication and management of 800,000 af of CVP-water yield annually. This (b)(2) water has been used to augment flows below CVP dams and to reduce CVP exports from the Delta. DOI manages and accounts for (b)(2) water pursuant to its May 9, 2003 decision and court decisions, including the Ninth Circuit Court of Appeals' decision in *Bay Institute of San Francisco v. United States*, 66 Fed. Appx. 734 (9<sup>th</sup> Cir. 2003), as amended, 87 Fed. Appx. 637 (2004). Additionally, DOI is authorized to acquire water to supplement (b)(2) water, pursuant to Section 3406(b)(3).

### *State Water Project (SWP)*

DWR was established in 1956 as the successor to the Department of Public Works for authority over water resources and dams within California. DWR was also given the authority to apply for the appropriation of water on behalf of the State (Stats. 1956, First Ex. Sess., Ch. 52; see also Wat. Code Sec. 123) and currently holds water rights permits used by the SWP. DWR's authority to construct State water facilities or projects is derived from the Central Valley Project Act (CVPA) (Wat. Code Sec. 11100 et seq.), the Burns-Porter Act (California Water Resources Development Bond Act) (Wat. Code Sec. 12930-12944), the State Contract Act (Pub. Contract Code Sec. 10100 et seq.), the Davis-Dolwig Act (Wat. Code Sec. 11900-11925), and special acts of the State Legislature. The CVPA described specific facilities that have been built by DWR, including the Feather River Project and California Aqueduct (Wat. Code Sec. 11260), Silverwood Lake (Wat. Code Sec. 11261), and the North Bay Aqueduct (Wat. Code Sec. 11270). The CVPA allows DWR to administratively add other units (Wat. Code Sec. 11290) and develop power facilities (Wat. Code Sec. 11295).

The Burns-Porter Act which was approved by California voters in November 1960 (Wat. Code Sec. 12930-12944), authorized the issuance of bonds for construction of the SWP. The principal facilities of the SWP are Oroville Reservoir and related facilities in the Feather River, the San Luis Dam and related facilities, two pumping plants in the Delta, the California Aqueduct including its terminal reservoirs, and the North and South Bay Aqueducts. DWR is required to plan for recreational and fish and wildlife uses of water in connection with State-constructed water projects and the agency can acquire land for those uses (Wat. Code Sec. 233, 345, 346, 12582). The Davis-Dolwig Act (Wat. Code Sec. 11900-11925) established the policy that preservation of fish and wildlife is part of State costs to be paid by water supply contractors, and recreation and enhancement of fish and wildlife are to be provided by appropriations from the General Fund.

DWR holds contracts with 29 public agencies in northern, central, and southern California for water supplies from the SWP. Water stored in Lake Oroville and the Thermalito Complex along with water available in the Delta (consistent with applicable regulations) is conveyed to SWP contractors via the Barker Slough and Banks Pumping Plants.

The SWP is operated to provide flood control and water for agricultural, municipal, industrial,

recreational, and environmental purposes. A large portion of the water stored in Oroville Reservoir is provided to three Feather River area contractors, two contractors served from the North Bay Aqueduct, and 24 contractors south of the Delta. In addition to pumping water released from Oroville Reservoir, both the Barker Slough and Banks Pumping Plants pump water entering the Delta from other managed and unmanaged sources of inflow.

## **Coordinated Operations of the CVP and SWP**

### *Coordinated Operation Agreement*

The Coordinated Operation Agreement (COA) between the United States and the State of California to operate the CVP and SWP was signed in November, 1986. Congress, through Public Law 99-546, authorized and directed the Secretary to execute and implement the COA. The COA defines the rights and responsibilities of the CVP and SWP with respect to in-basin water needs and project exports and provides a mechanism to account for those rights and responsibilities.

Under the COA, Reclamation and DWR agree to operate the CVP and SWP under balanced conditions in a manner that meets Sacramento Valley and Delta needs while maintaining each project's annual water supplies. Balanced conditions are defined as periods when the two projects agree that releases from upstream reservoirs, plus unregulated flow, approximately equal water supply needed to meet Sacramento Valley in-basin uses and project exports. Coordination between the CVP and the SWP is facilitated by an accounting procedure based on the sharing principles outlined in the COA. During balanced conditions in the Delta when water must be withdrawn from storage to meet Sacramento Valley and Delta requirements, 75% of the responsibility to withdraw from storage is borne by the CVP and 25% by the SWP. The COA also provides that during balanced conditions when unstored water is available for export, 55% of the sum of stored water and the unstored water for export is allocated to the CVP, and 45% is allocated to the SWP. Although the principles were intended to cover a broad range of conditions, changes made subsequent to the COA, including the 2000 Trinity Record of Decision, recent BiOps, the SWRCB WQCP, and the CVPIA were not specifically addressed by the COA. However, these variances have been addressed by Reclamation and DWR through mutual, informal agreements.

### *1995 SWRCB Water Quality Control Plan*

The SWRCB adopted the 1995 Bay-Delta WQCP (SWRCB 1995) on May 22, 1995, which became the basis of SWRCB Decision 1641 (D-1641) in 2000. The SWRCB continues to hold workshops and receive information regarding processes on specific areas of the 1995 WQCP. The SWRCB amended the WQCP in 2006, but to date, the SWRCB has made no significant changes to the 1995 WQCP framework.

### *SWRCB Decision 1641 and Revised D-1641*

The SWRCB has issued numerous orders and decisions regarding water quality and water right

requirements for the Bay-Delta including multiple operational responsibilities on the CVP and SWP to meet the flow objectives in D-1641 (issued December 29, 1999) and its subsequent revision (Revised D-1641, dated March 15, 2000). The SWRCB objectives set forth in the WQCP are intended to protect beneficial uses of water in the Delta. The SWRCB is currently considering a petition to change points of diversion in support of CWF and an update to the WQCP that could change the operational assumptions reflected in the CWF BA. Operation of the CWF will need to be consistent with decisions of the Board in both the WQCP and point of diversion petition processes.

The various flow objectives and export limits in D-1641 are designed to protect the estuary ecosystem, in-Delta agriculture and regional municipal water quality. These objectives include salinity requirements throughout the year, and export to inflow ratio limits in February through June. The water quality objectives vary within and between years according to the Sacramento Valley 40-30-30 WY Index: Wet, Above-normal, Below-normal, Dry, and Critically Dry. These flow and water quality objectives are subject to revision per petition process or every 3–5 year revision process set by the SWRCB.

#### *2006 SWRCB Revised Water Quality Control Plan*

The SWRCB undertook a proceeding under its water quality authority to amend the WQCP. Prior to commencing this proceeding, the SWRCB conducted a series of workshops in 2004 and 2005 to receive information on specific topics addressed in the WQCP.

The SWRCB adopted a revised WQCP on December 13, 2006. There were no changes to the Beneficial Uses from the 1995 WQCP to the 2006 WQCP, nor were any new water quality objectives adopted in the 2006 WQCP. A number of changes were made for readability. Consistency changes were also made to assure that sections of the 2006 plan reflected the current physical condition of the estuary and regulations existing at that time.

#### *Current Water Quality Control Plan Process*

The SWRCB is currently in the process of developing and implementing updates to its 2006 WQCP. The update has been broken into four phases, some of which are proceeding concurrently. Phase 1 of this work, currently in progress, involves updating San Joaquin River flow and southern Delta water quality requirements for inclusion in the WQCP. Phase 2 will involve comprehensive changes to the WQCP to protect beneficial uses not addressed in Phase 1, focusing on the Sacramento River basin and the Delta. Phase 3 will involve implementation of Phases 1 and 2 through changes to water rights and other measures. This phase will require a series of hearings to determine the appropriate allocation of responsibility between water rights holders within the scope of the Phase 1 and Phase 2 plans. Phase 4 will involve developing and implementing flow objectives for priority Delta tributaries upstream of the Delta.

#### *Annual/Seasonal Temperature Management Upstream of the Delta*

Reclamation is required to control water temperature in the Sacramento River pursuant to

SWRCB Order WR 90-5 and Action Suite I.2 of the RPA in the NMFS 2009 BiOp. Reclamation is required to develop and implement an annual Temperature Management Plan by May 15 each year to manage the cold water supply within Shasta Reservoir and make cold water releases from Shasta Reservoir, and Trinity Reservoir through the Spring Creek Tunnel, to provide suitable temperatures for winter-run Chinook salmon, and, when feasible, fall-run Chinook salmon, which supports an important commercial fishery and a prey base for listed Southern Resident DPS killer whale.

NMFS has been working with Reclamation to amend the RPA Action Suite I.2. The amendment is being made pursuant to the 2009 NMFS BiOp Section 11.2.1.2. Research and Adaptive Management, which states “After completion of the annual review, NMFS may initiate a process to amend specific measures in this RPA to reflect new information, provided that the amendment is consistent with the Opinion’s underlying analysis and conclusions and does not limit the effectiveness of the RPA in avoiding jeopardy to listed species or adverse modification of critical habitat.” The basis for the proposed RPA amendment included recent, multiple years of drought conditions, new science and modeling, and data demonstrating the low population levels of endangered Sacramento River winter-run Chinook salmon and threatened Central Valley spring-run Chinook salmon. This process resulted in a one year pilot study to the existing seasonal temperature management processes to evaluate the proposed amendments to Shasta operations, which include temperature dependent mortality biological objectives, spring Shasta Reservoir storage targets, and revised temperature compliance criteria. It remains to be seen whether the revised RPA Action Suite I.2 will affect inflows to the Delta.

## **Drought Operations and Management**

### *Drought Contingency Plan and Temporary Urgency Change Petitions*

The exceptionally dry conditions in 2014, 2015, and 2016 resulted in low reservoir storages which created a challenge to deliver water supplies, provide adequate cold water for instream fisheries resources, and comply with D-1641 standards. During 2014, 2015 and 2016, Reclamation and DWR petitioned the SWRCB on several occasions to temporarily modify the terms of their water rights permits for operation of the CVP and SWP. The SWRCB Executive Director approved Orders for temporary urgency changes to D-1641 standards to help Reclamation and DWR deliver minimum water supplies. The granted requests and information related to the drought workshops can be found online at: [http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/drought/tucp/index.shtml](http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/tucp/index.shtml).

### *West False River Temporary Emergency Drought Barrier*

An emergency drought barrier was installed at West False River between Jersey and Bradford Islands in May and June 2015 to prevent tidal pumping of saltwater into the central Delta during a period of extremely low Delta outflow. The 750-foot rock barrier allowed the CVP and SWP water facilities to meet relaxed salinity standards while conserving limited water supply in the Projects’ reservoirs. The barrier was removed in the fall of 2015. The barrier was installed near the end of the delta smelt’s spawning season. The barrier prevented delta smelt from utilizing

that corridor as a path for migration or dispersal, possibly increasing the risk of predation if fish were dispersed into Franks Tract. These types of drought operation could be considered in the future if exceptionally dry conditions are repeated.

#### **9.2.1.4.2 Other Existing Conditions and Consultations in the Action Area**

The following past and ongoing actions affect the current and future status of delta smelt and its critical habitat in the action area.

##### **Freeport Regional Water Project**

The Freeport Regional Water Project (FRWP) is an on-bank intake with a diversion capacity of 286 cubic feet per second (cfs) and a fish screen of approximately 175 ft in length (<http://www.freeportproject.org/nodes/aboutfrwa/>). The facility is located along the Sacramento River near Freeport and supplies water to Sacramento County and East Bay Municipal Utility District (EBMUD). EBMUD diverts water pursuant to its amended contract with Reclamation. Sacramento County diverts water pursuant to its water right and its CVP contract. This facility was not in the 1986 COA, but is considered an in basin use under COA. A BiOp for the construction, operation, and maintenance of the facility was issued in 2004 (Service 2004) and the water exports associated with the Freeport Intake were addressed in the 2008 Service BiOp (Service 2008) and previously the 2004 Operations Criteria and Plan (OCAP BiOp) (Service 2004).

The FRWP has a design capacity of 286 cfs (185 millions of gallons per day [mgd]). Up to 132 cfs (85 mgd) is diverted under Sacramento County's existing Reclamation water service contract and other anticipated water entitlements and up to 155 cfs (100 mgd) of water is diverted under EBMUD's amended Reclamation water service contract. To date, average annual deliveries to EBMUD have been approximately 23,000 AF. Thus far, maximum annual delivery has been approximately 99,000 AF.

The FRWP intake is within critical habitat and resulted in the loss of delta smelt spawning habitat. The adverse effects of entrainment and impingement on delta smelt were minimized by the construction of a fish screen designed to meet CDFW and NMFS criteria and recommendations provided by the Service. The intake screens were built and operate to a 0.2 feet per second (fps) approach velocity for the protection of delta smelt.

##### **South Delta Temporary Barriers Project**

The South Delta Temporary Barriers Project began as a test project in 1991 and was extended for five years in 1996 and again for seven years in 2001. The project consists of four rock barriers across south Delta channels (see Figure 9.2.1.4.2-1). Three of the four rock barriers are in place from April 15 to September 30 each year to maintain water levels needed by local irrigators. The fourth, the HOR rock barrier, serves as a fish barrier that has been seasonally installed most years since 1963 between September 15 and November 30. Beginning in 1992, it is also frequently

installed in the spring. Since 2008, the HOR rock barrier has been installed in the spring in 2012, 2014, 2015, and 2016 and fall of 2014 and 2015.

Objectives of the project are to:

- Increase water levels, circulation, and water quality in the southern Delta area for local agricultural diversions, and
- Incentivize salmonid fishes to stay in the mainstem of the San Joaquin River.

The PA proposes to continue the temporary barriers project but to replace the HOR rock barrier with a permanent operable gate, the HORG.

Prior to explicit limits on OMR flows, the installation of the HOR barrier during spring could create rapid changes in south Delta hydrodynamics that were associated with spikes in juvenile delta smelt salvage because the barrier increased net negative flow in Old and Middle river if exports were not simultaneously reduced. The OMR flow limits in the Service's 2008 BiOp help minimize the entrainment risk associated with barrier placement.



## **Maintenance Dredging and Sand-mining**

The maintaining of levees, Federal navigation channels, and other infrastructure projects throughout the Bay-Delta has resulted in the disturbance and removal of habitat, in addition to the harassment or mortality of delta smelt (Service 1993; 1994). The maintenance of these levees and shipping channels reduces nearshore habitat suitability for delta smelt and increases the quantities of freshwater needed to maintain the low-salinity zone in particular locations. The proposed deepening of these channels would worsen these habitat problems.

### **Suisun Navigation Channel Project**

The Corps consulted with the Service to conduct their annual maintenance dredging in the Suisun Bay Federal Navigation Channels (SBFNC). The SBFNC includes several reaches, from west to east: Bulls Head Channel, Suisun Bay Main Channel (comprised of Point Edith Crossing, Preston Point Reach, Roe Island Channel, and Port Chicago Reach) and New York Slough. Maintenance activities have included the use of hydraulic suction dredging and mechanical clamshell dredging equipment. Delta smelt have been entrained with the hydraulic suction dredging. The Corps used clamshell dredging equipment in 2015 and 2016 to minimize effects.

### **Stockton and Sacramento Deep Water Ship Channel Dredging and Bank Stabilization Project**

The Corps has consulted with the Service to conduct its annual operations and maintenance dredging in the Sacramento River Deep Water Ship Channel (SRDWSC) and Stockton Deep Water Ship Channel (SDWSC). All sites along the SRDWSC and SDWSC are dredged to maintain the current navigational depths. The SRDWSC begins in the city of West Sacramento and extends southwest to Collinsville. The SDWSC extends from New York Slough near Pittsburg to Stockton along the San Joaquin River. The SRDWSC varies in width from 200 to 400 ft. The ship channel was proposed to be deepened and widened as authorized under the Water Resources Development Act of 1986 (Public Law 99-662). The channel was proposed to be deepened along its entire length and widened to bottom widths ranging from 250 to 400 ft. Due to funding and other constraints, the PA was not completed. As of the beginning of 2014, only the upstream most 8 miles, RM 35 to the turning basin, of the ship channel have been deepened and the only widening that occurred was that necessary to maintain a 1:3 side slope for the deeper channel.

The current shipping channel maintenance projects use a hydraulic cutter head suction dredge for dredging. In 2016, operational changes were made to reduce delta smelt entrainment. In 2015, the Service requested cessation of the fish monitoring surveys associated with this dredging to minimize take of delta smelt.

## **Jerico Products, Hanson Marine Operations, and Suisun Associates Marine Sand-mining Project**

Jerico Products, Hanson Marine Operations, and their joint-venture partnership Suisun Associates are commercial sand mining companies that have leases in Suisun Bay and the western Delta to harvest sand for construction-related material using hydraulic dredging methods. The Corps consulted with the Service in 2014 on their ten-year marine sand-mining lease project proposal.

The amount and seasonal timing of mining volumes are largely dictated by demand for sand and the weather. Generally, sand mining peaks in the summer and early fall when commercial and residential construction is also at its annual peak. Mining activity in the period from July – October historically makes up over 43% of the total annual volume.

Permit requirements, such as prohibiting mining near the shoreline and in shallow areas, help protect delta smelt spawning habitat and fringing marsh habitats. Bathymetric surveys are also proposed as part of the project to provide a basis for routinely monitoring subtidal conditions within areas where mining takes place and to detect and assess biologically significant changes in subtidal benthic habitat. Monitoring of each individual sand mining event and bathymetric monitoring is required as part of the Corps permit. Tracking mining locations serves to ensure that mining occurs only within designated lease areas and that mining avoids sensitive subtidal habitat located outside of a lease area.

## **Suisun Marsh Managed Wetland Operations and Maintenance**

The Service issued a BiOp for the *Suisun Marsh Habitat Management, Preservation, and Restoration Plan* (Suisun Marsh Plan) on June 10, 2013 for the continued operation and maintenance of managed wetlands in the Suisun Marsh that are an important component of the Pacific Flyway. Also included are: new managed wetland activities; dredging; installing alternative bank protection; placing new riprap; and installing fish screens. The BiOp also consisted of a programmatic-level restoration plan for restoring 5,000 to 7,000 acres of natural tidal marsh in the Suisun Marsh (see Suisun Marsh Plan in 9.2.1.4.4 *Regional Conservation Efforts* below). Details of the project-level activities associated with the managed wetland activities can be found online at: [https://www.fws.gov/sfbaydelta/documents/2012-F-0602-2\\_Suisun\\_Marsh\\_Solano\\_County\\_Corps\\_programmatic.pdf](https://www.fws.gov/sfbaydelta/documents/2012-F-0602-2_Suisun_Marsh_Solano_County_Corps_programmatic.pdf).

## **Aquatic Weed Control Program**

The Division of Boating and Waterways (DBW) is the lead agency to cooperate with other State, local, and Federal agencies in controlling aquatic weeds in the Delta, its tributaries, and the Suisun Marsh. This includes controlling water hyacinth, the Brazilian water weed (*Egeria densa*), curly-leaf pondweed and Spongeplant. These programs are not intended to eradicate the species, but to control their spread. Thus far, they have not been successful. Spraying treatments in the Delta are restricted to March 1 through November 30. DBW is permitted to treat 3,500 acres in the following areas: west up to and including Sherman Island at the confluence of the

San Joaquin and Sacramento rivers, north to the confluence of the Sacramento River through the Sacramento Deep Water Channel, plus Lake Natomas, south along the San Joaquin River to Mendota, and all the tributaries to the San Joaquin, Tuolumne, Merced and Stanislaus rivers.

### **Wallace Weir Modification Project**

The Wallace Weir Modification Project began construction in winter of 2016. Wallace Weir is a permanent, operable structure that provides year-round operational control of the weir's hydraulics. Modifications include replacement of the seasonal earthen dam with an operable weir. The project will also include a fish rescue facility that would return fish back to the Sacramento River. Wallace Weir has been treated as a common element to the larger habitat restoration and fish passage projects included in the 2009 NMFS BiOp. The project will serve primarily as an anadromous fish passage improvement action that will prevent adult salmonids and sturgeon from getting into the Colusa Basin Drain. Operational control of water levels would also provide greater flexibility for managing water releases for agriculture and managed wetlands. Management and operations of the Yolo bypass have the potential to influence food supply contributions downstream into the Cache Slough Complex and connecting waterways. The Cache Slough Complex has been documented for delta smelt rearing, making food supply availability, quality, and quantity important factors to those rearing individuals.

### **Sacramento Area Levees**

In March of 2015, the Corps completed a draft general reevaluation study of the American River Common Features project for the City of Sacramento and surrounding areas. This study addresses the flood risk management system for the American and Sacramento Rivers and five other smaller channels. The study is located in the general vicinity of the confluence of the Sacramento and American rivers, and includes the City of Sacramento and surrounding areas including the American River downstream of Folsom Dam, the Natomas Basin, the east bank of the Sacramento River and areas surrounding five other smaller waterways which are sources of potential flooding. Some of these areas overlap the action area for the PA. This project will remediate levee seepage problems along approximately 22 miles of the American River. It will also strengthen and raise 12 miles of Sacramento River levee in Natomas. Lastly, the authorization includes seepage remediation and higher levees along four stretches of the American River and 5 miles of the Natomas Cross Canal levee.

### **Small Erosion Repair Program**

The Small Erosion Repair Program (SERP) provides a streamlined process for DWR to identify, obtain regulatory authorization for, and construct small levee repairs on levees maintained by DWR within the Sacramento River Flood Control Project area. The initial focus of SERP covers approximately 300 miles of levees and represents an initial five-year effort. After the first phase, the Interagency Flood Management Collaborative Program Group will evaluate the program's success and, if warranted, SERP may be expanded to include sites repaired by local agencies throughout the Sacramento-San Joaquin drainage. Similar to previous initiatives, these small

levee repairs will slowly increase levee riprapping along the Sacramento River, further degrading the quality of habitat for delta smelt.

#### **9.2.1.4.3 Existing Monitoring and Research Programs**

Monitoring surveys targeting delta smelt and other fishes and invertebrates are conducted throughout the year under the auspices of the Interagency Ecological Program (IEP) (Hartman, CDFW, personal communication; Figure 9.2.1.4.3-1 through 9.2.1.4.3-6). Historically, take in survey collections was low compared to estimated abundances (Bennett 2005); however, given the combination of recent population decline and substantial increase in survey effort, scientific take may be reaching a relevant fraction of the delta smelt population in some seasons. Because of low abundance and a high level of sampling mortality, some survey methods have been modified to limit incidental catches of delta smelt when delta smelt is not the target species (*e.g.*, the Service's Chipps Island trawl, which targets the recapture of tagged Chinook salmon).

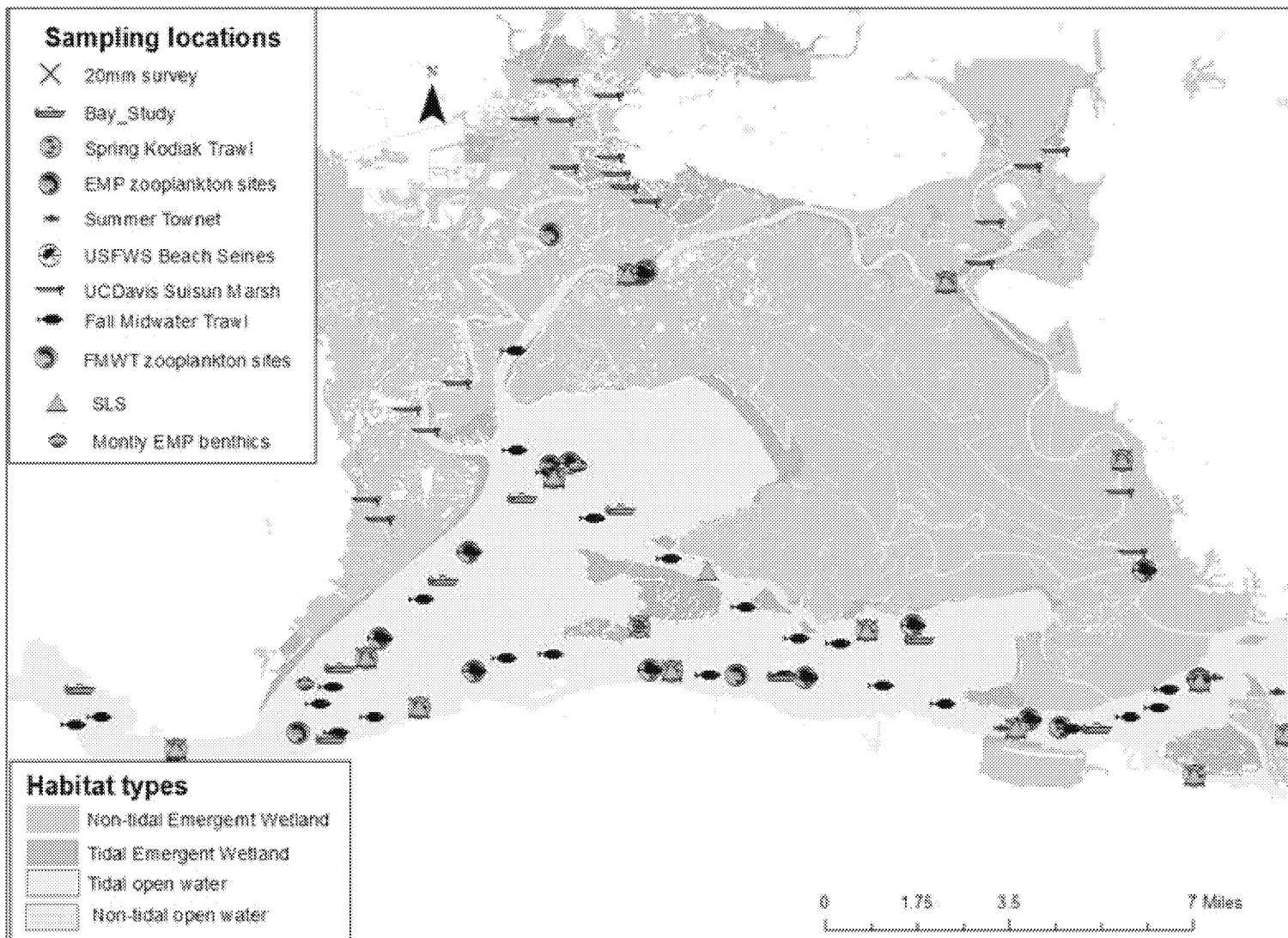


Figure 9.2.1.4.3-1. Sampling locations in the Suisun Marsh for invertebrates and fish.

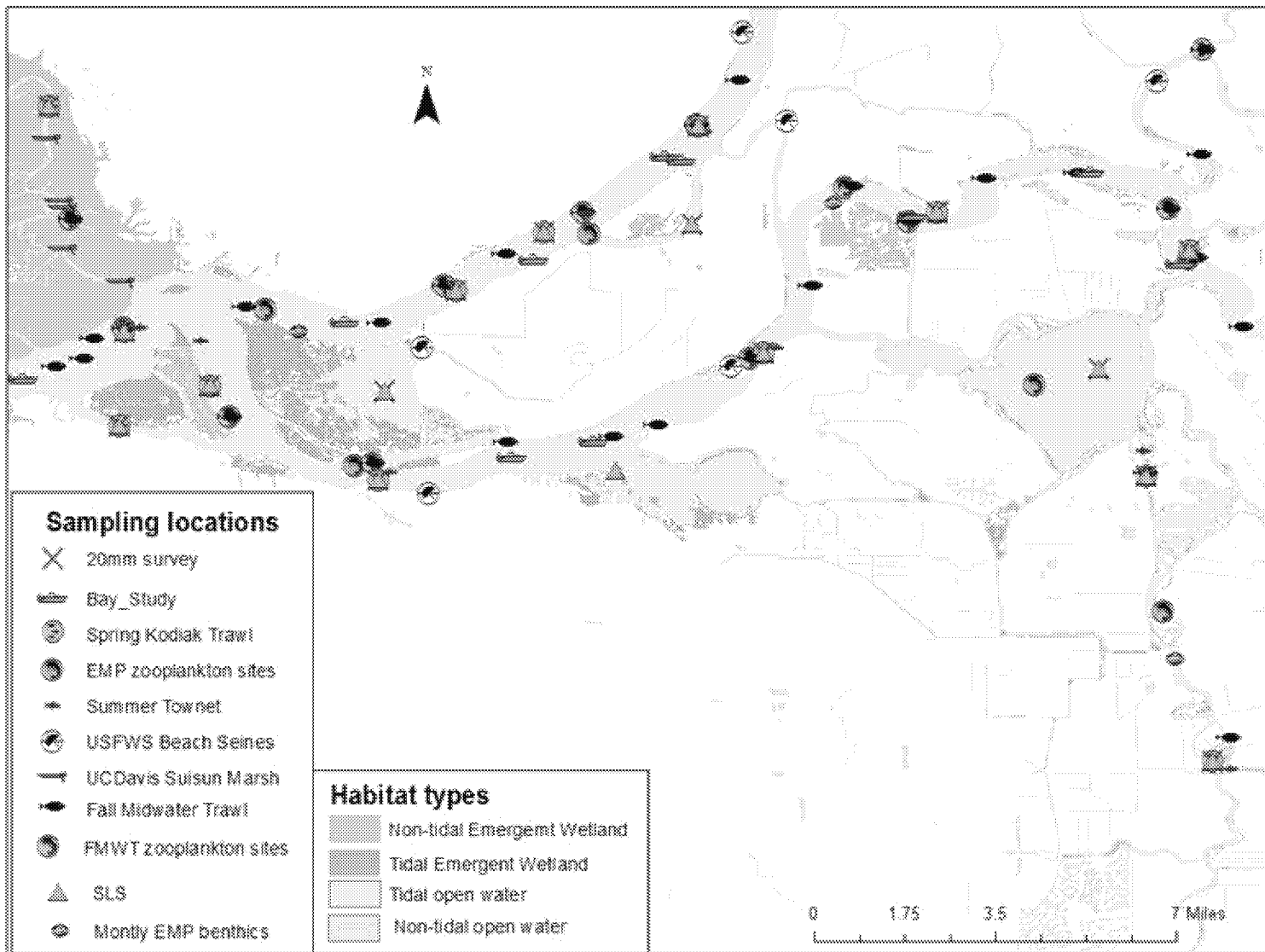


Figure 9.2.1.4.3-2. Sampling locations in the west Delta for invertebrates and fish.

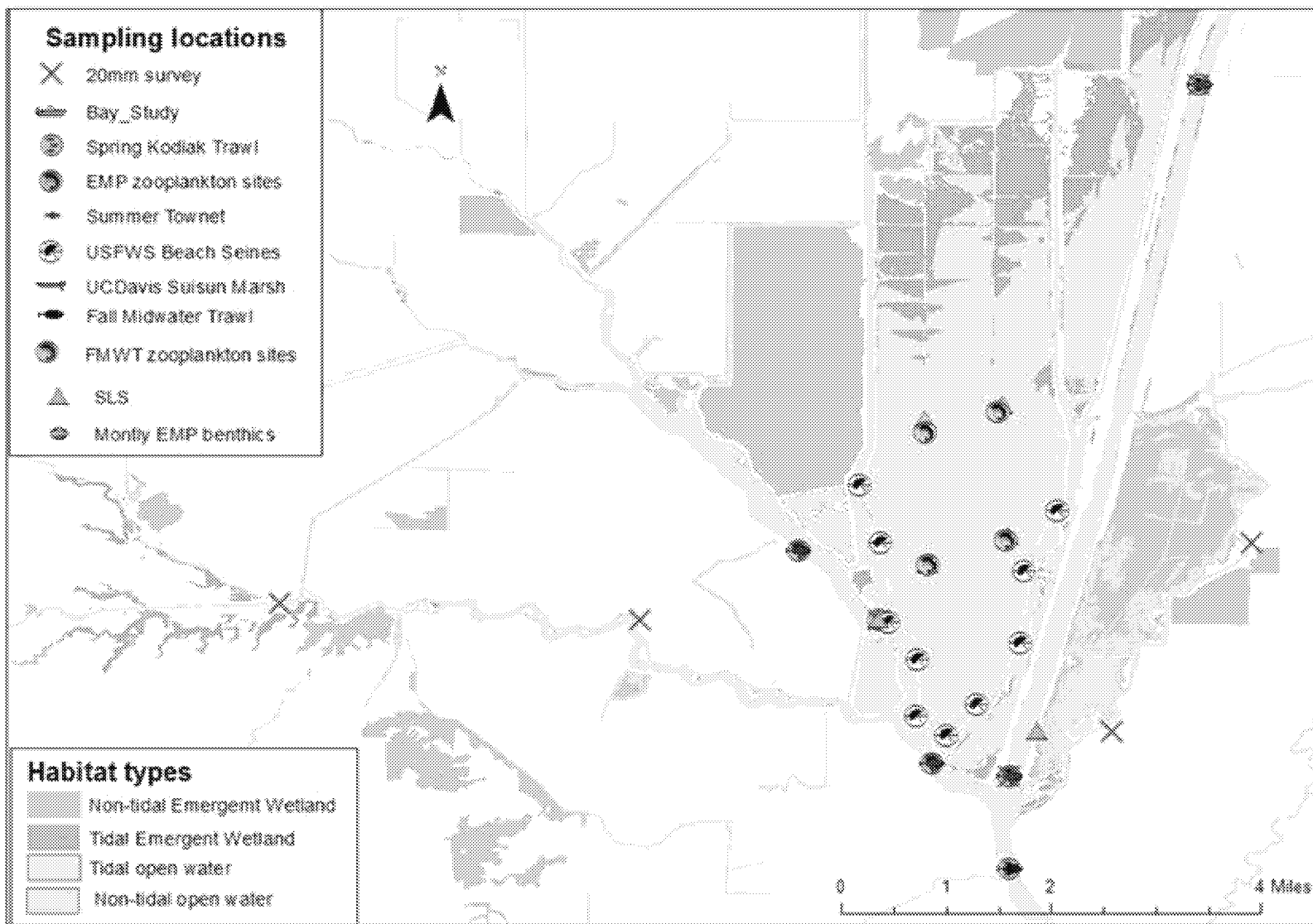


Figure 9.2.1.4.3-3. Sampling locations in the Cache Slough Complex for invertebrates and fish.

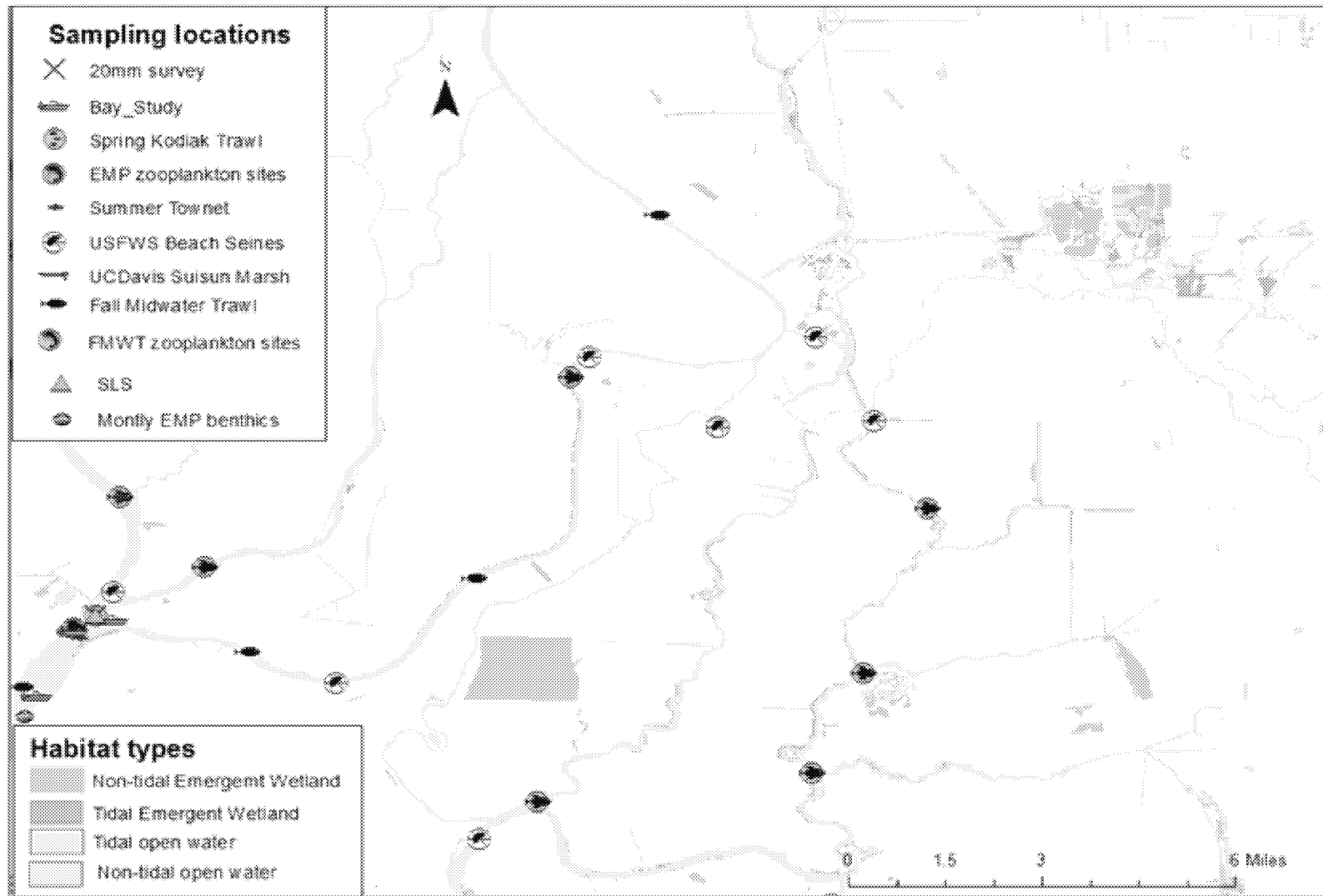


Figure 9.2.1.4.3-4. Sampling locations in the north Delta for invertebrates and fish.

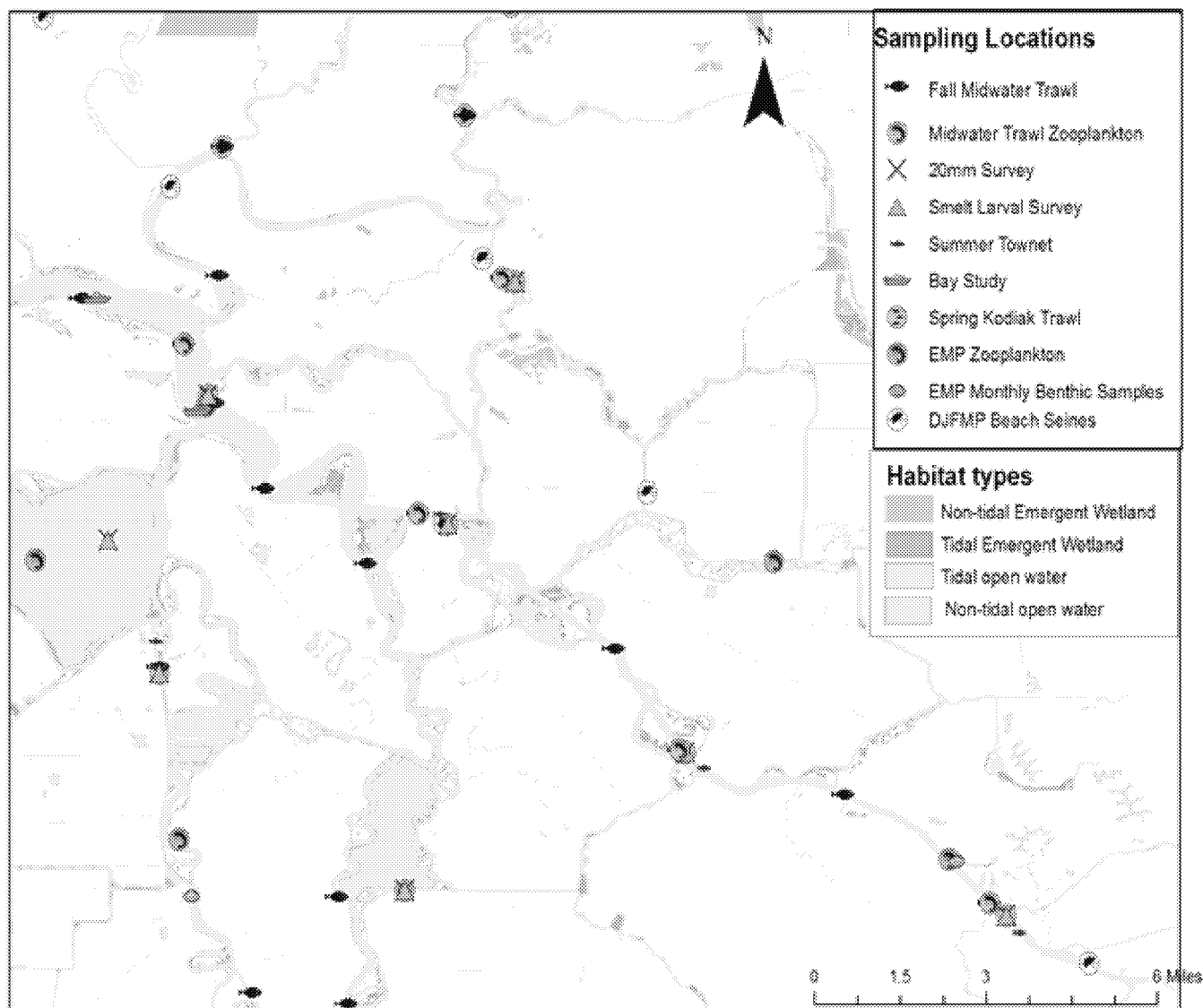


Figure 9.2.1.4.3-5. Sampling locations in the east Delta for invertebrates and fish.

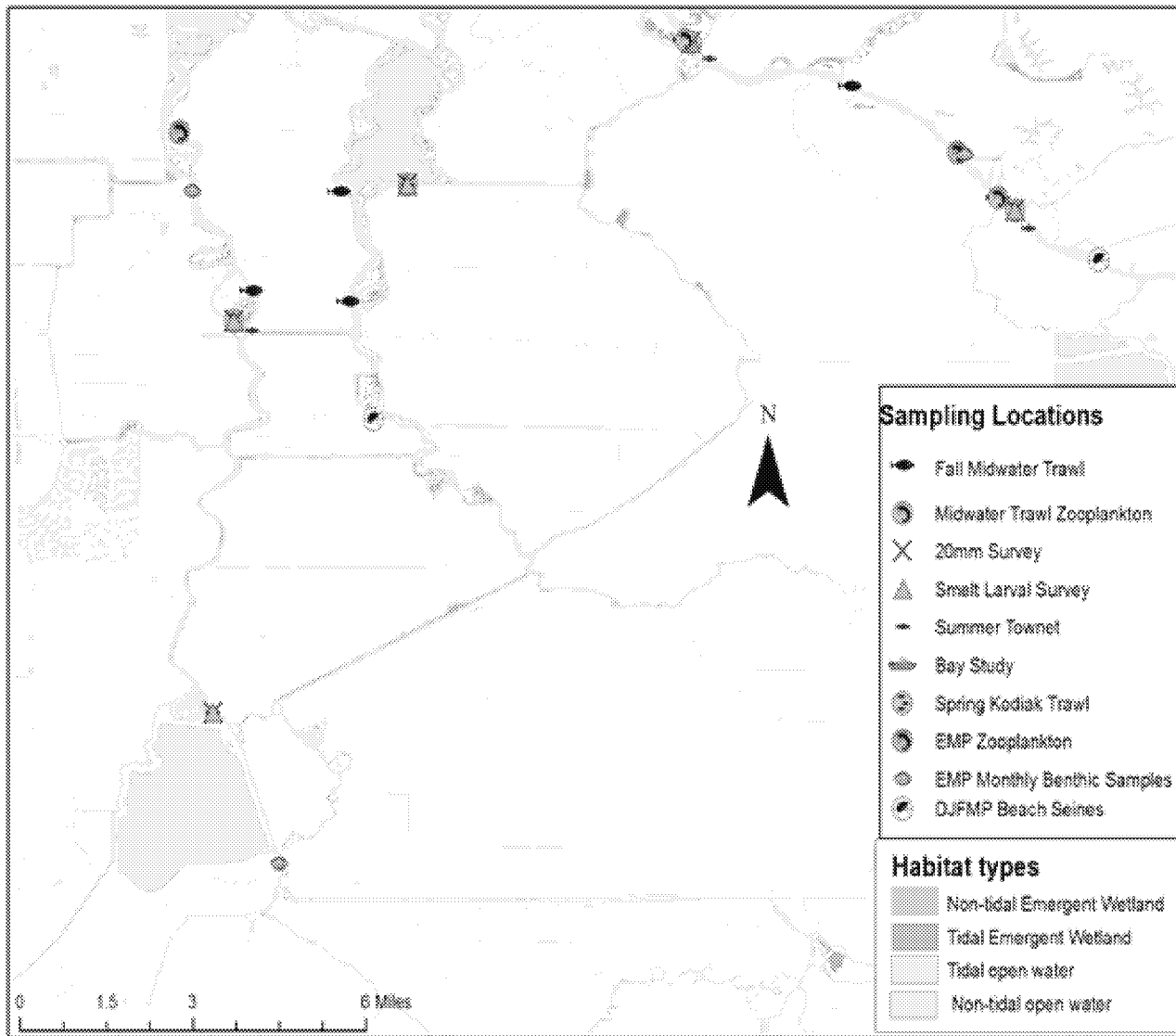


Figure 9.2.1.4.3-6. Sampling locations in the south Delta for invertebrates and fish.

## **Interagency Ecological Program for the San Francisco Estuary**

The mission of the IEP is, in collaboration with others, to provide ecological information and scientific leadership for use in management of the San Francisco Estuary. The goals of IEP are to: describe the status and trends of aquatic ecological factors of interest in the estuary, develop an understanding of environmental factors that influence observed aquatic ecological status and trends, use knowledge of the above information in a collaboration process to support natural resource planning, management, and regulatory activities in the estuary, continually reassess and enhance long-term monitoring and research activities that demonstrate scientific excellence, and to provide scientific information about the estuary that is accurate, accessible, reliable, and released in a timely manner. Since its inception in 1972, IEP has been the principal entity coordinating ecological investigations, science collaboration and fish monitoring in the Bay-Delta.

Most research and monitoring of fish populations in the Bay-Delta is coordinated through the IEP. The IEP is a cooperative effort led by State and Federal agencies with university and private partners (<http://www.water.ca.gov/iep/>). Several of the IEP's monitoring programs capture delta smelt. However, only four sample efficiently enough for delta smelt to be commonly used to index the species' abundance or distribution, and only three (Spring Kodiak Trawl Survey, 20-mm Survey, and Enhanced Delta Smelt Monitoring) are designed specifically to target delta smelt.

A summary of the number of individuals that were reported from IEP studies from 2005 through 2016 is presented in Tables 9.2.1.4.3-1, 9.2.1.4.3-2, and 9.2.1.4.3-3.

**Table 9.2.1.4.3-1. Number or larvae delta smelt individuals captured from 2005-2016 from IEP studies.**

Larvae (<20 mm FL)												
Survey	Year											
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fall Midwater Trawl	0	0	0	0	10	0	0	0	0	0	0	0
Townet Survey			10	82	49	198	470	246	171	75	0	0
SF Bay Study	0	0	0	0	0	0	0	0	0	0	0	1
South Delta fish investigations	8		277									
20-mm*	644	978	135	274	435	833	1162	1076	1125	256	99	126
Yolo Bypass	0	0	0	0	0	0	0	0	0	0	0	0
Delta Juvenile Fish Monitoring	14										0	0
Directed Fish Collections			2									
Upper estuary zooplankton			2	17		10	3	3	5	1	0	0
Investigation of Antioch and Pittsburg Power Plants				17	10	1	1					
Spring Kodiak Trawl	26					1		1	2	53	3	26
Morrow Island Distribution			1									
UCD Suisun Marsh										2	0	0
Smelt Larva Survey		79	274	0	0	6	3	238	118	24	6	8
Mossdale Spring Trawl											0	0
Fish Community Monitoring				22								
Pilot Mark-recap to Estimate Pre-screen Loss and Salvage Efficiency					111							
Gear Efficiency Evaluation in Support of Delta Smelt Modeling									85	147	0	0
FRP Tidal Wetland Monitoring Study											0	0
USGS Early Warning											0	0
USGS Physical and Biological Drivers												0
TOTAL	692	1057	701	412	615	1049	1639	1564	1506	558	108	161
*20mm Study reports larvae and juveniles together (age-0). Age-1+ reported as adults.												

**Table 9.2.1.4.3-2. Number of juvenile and adult delta smelt individuals captured from 2005-2016 for IEP studies.**

<b>Juveniles and Adults (&gt;=20 mm FL)</b>												
<b>Survey</b>	<b>Year</b>											
	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Fall Midwater Trawl	28	39	27	21	32	54	344	47	21	11	7	7
Townet Survey	120	83	45	0	0	2	318	28	0	1	23	6
SF Bay Study	85	21	64	45	20	49	181	95	77	43	51	6
20-mm	15	0	2	1	2	5	8	63	9	1	0	2
Yolo Bypass	4	17	4	26	88	19	31	133	134	46	50	18
Broodstock Collections (FCCL)	2297	2418		70	23	80		2	198			
Delta Juvenile Fish Monitoring	761	954	245	119	136	445	956	710	464	301	245	103
New Technologies and Release Sites, Element 2 (Electrofishing)				2								
Indicators to Predict Adverse Effects to Salvaged Delta Smelt	64											
Fish Predation in the CHTR Phase	19											
Acute Mortality Associated with CHTR		28										
Directed Fish Collections	5	371	4									
Upper estuary zooplankton						1	2	2	0	1	0	0
Investigation of Antioch and Pittsburg Power Plants				2	14		0					
Spring Kodiak Trawl	1311	473	708	339	671	659	445	1204	339	356	107	260
Morrow Island Distribution	2	1										
UCD Suisun Marsh	2	1	3	1	4	2	22	10	6	7	3	0
Smelt Larva Survey		1	0	0	2	0	2	10	4	0	2	0
Mossdale Spring Trawl						1			0	0	0	0
Fish Community Monitoring			3	3	8		9					
Effects of Largemouth Bass on Delta Ecosystem						5						
Pilot Mark-recap to Estimate Pre-screen Loss and Salvage Efficiency				189	10							
Smelt Migration Study (AKA First Flush)**						659		822				
Gear Efficiency Evaluation in Support of Delta Smelt Modeling								721	863	890	185	0
FRP Tidal Wetland Monitoring Study											0	2
USGS Early Warning											0	42
USGS Physical and Biological Drivers												1
<b>TOTAL</b>	<b>4713</b>	<b>4407</b>	<b>1105</b>	<b>818</b>	<b>1010</b>	<b>1981</b>	<b>2318</b>	<b>3847</b>	<b>2115</b>	<b>1657</b>	<b>673</b>	<b>447</b>

\*Smelt Migration sampling in year 2010 includes one day of sampling in 2011

**Table 9.2.1.4.3-3. Number of adult delta smelt individuals for all life stages reported from 2005-2016 for IEP studies.**

All life stages combined												
Survey	Year											
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fall Midwater Trawl	28	39	27	21	42	54	344	47	21	11	7	7
Townet Survey	120	83	55	82	49	200	788	274	171	76	23	6
SF Bay Study	85	21	64	45	20	49	181	95	77	43	51	7
South Delta Fish Investigations	8	0	277									
20-mm	659	978	137	275	437	838	1170	1139	1134	257	99	128
Yolo Bypass	4	17	4	26	88	19	31	133	134	46	50	18
Broodstock Collections	2297	2418		70	23	80		2	198			
Delta Juvenile Fish Monitoring	775	954	245	119	136	445	956	710	464	301	245	103
New Technologies and Release Sites, Element 2 (Electrofishing)	0			2								
Indicators to Predict Adverse Effects to Salvaged Delta Smelt	64											
Fish Predation in the CHTR Phase	19											
Acute Mortality Associated with CHTR	0	28										
Directed Fish Collections	5	371	6									
Upper estuary zooplankton	0		2	17		11	5	5	5	2	0	0
Investigation of Antioch and Pittsburg Power Plants				19	24	1	1					
Spring Kodiak Trawl	1337	473	708	339	671	660	445	1205	341	409	110	286
Morrow Island Distribution	2	1	1									
UCD Suisun Marsh	2	1	3	1	4	2	22	10	6	9	3	0
Smelt Larva Survey		80	274		2	6	5	248	122	24	8	8
Mossdale Spring Trawl	0					1				0	0	0
Fish Community Monitoring			3	25	8	0	9					
Effects of Largemouth Bass on Delta Ecosystem						5						
Pilot Mark-recap to Estimate Pre-screen Loss and Salvage Efficiency				189	121							
Smelt Migration Experiment (AKA First Flush)						659		822				
Gear Efficiency Evaluation in Support of Delta Smelt Modeling								721	948	1037	185	0
FRP Tidal Wetland Monitoring Study											0	2
USGS Early Warning											0	42
USGS Physical and Biological Drivers												1
TOTAL	5405	5464	1806	1230	1625	3030	3957	5411	3621	2215	781	608

### ***Enhanced Delta Smelt Monitoring***

The objective of the Service's Enhanced Delta Smelt Monitoring (EDSM) is to provide data for calculating life stage-specific estimates of abundance, spatial distribution, and proportion at risk of entrainment for selected life stages and times of year. The monitoring program aims to collect data that will yield estimates with greater precision and less selection bias than estimates based on catches from existing surveys, namely, the SKTS, 20mm, TNS, and FMWT Surveys. There are three key differences between EDSM and existing surveys: (1) the most efficient gear for each life stage will be used, (2) for each sampling occasion, trawling locations will be chosen at random using a spatially representative selection procedure such as Generalized Random Tessellation Stratified sampling or Balance Acceptance Sampling, and (3) sampling is done up to four times per week at approximately 24 randomly selected locations throughout the range occupied by the relevant delta smelt life stage, and multiple tows will be taken at each sample location.

### **Other Delta Smelt Research**

#### ***Liberty Island***

In 2009, the Stockton Fish and Wildlife Office (now Lodi Fish and Wildlife Office (LFWO)) served a critical role in developing and facilitating a collaborative interdisciplinary study known as Breach III to assess the effects of restoration on aquatic biota inhabiting the tidally influenced freshwater wetlands at Liberty Island and Little Holland Tract in Yolo County, California. The goals of the Breach III project are to provide a predictive level of understanding about (1) how restoration activities influence local flooding and levee erosion, and (2) how abiotic and biotic factors control aquatic vegetation, fish, and wildlife distributions. The study was designed to simultaneously address the macroinvertebrate and fish response portions of the study at Liberty Island and evaluate the use of a restoring wetland complex by specific life stages of delta smelt, longfin smelt, Chinook salmon, striped bass, threadfin shad, and Sacramento splittail.

This program documented year-around occurrence of delta smelt in Liberty Island and confirmed that some individuals used the tidal marsh edge in northern Liberty Island as foraging habitat. This study provided the Service with greater certainty that wetland restoration in this part of the Delta will provide benefits to delta smelt.

#### ***The Arc Project: Suisun Marsh, Sherman Lake, and the North Delta***

This project aims to provide a better understanding of how land and vegetation in the Delta interact with river flow and tides to create habitat favored by native fishes. Scientists, engineers and resource managers expect to use this information to identify areas and conditions of high potential for habitat improvement throughout the Delta. The investigation focuses on regions in the north Delta where contemporary fish surveys have shown relatively high populations of native fishes - regions including Suisun Marsh, the flooded Sherman Island and

the Cache and Lindsey sloughs. The areas together form an arc, inspiring the project name "North Delta Arc of Native Fishes."

#### **9.2.1.4.4 Regional Conservation Efforts**

##### **Fish Conservation and Culture Lab and Livingston Stone National Fish Hatchery Refugial Populations**

The Fish Conservation and Culture Laboratory (FCCL) has been operated by the University of California, Davis since 1996 (FCCL 2016) and contains a refugial population of delta smelt. In 2007, CDFW and the Service began holding the second refugial population at the Service's Livingston Stone National Fish Hatchery (LSNFH). The goal of both refugial populations (FCCL and LSNFH) is to maintain a population in captivity that is very close to the wild population both in terms of phenotype and genotype to serve as a safeguard against extinction. The delta smelt culture techniques have been continuously improved over the years and the survival rate of cultured delta smelt at the FCCL is high (Lindberg *et al.* 2013). Approximately 260-300 families of delta smelt are maintained at the FCCL annually; delta smelt from the wild contribute to each new generation and are currently required to avoid genetic drift (Fisch *et al.* 2012).

##### **Tidal Marsh Recovery Plan**

This California coast-wide, multi-species recovery plan, published in 2013, includes conservation needs for the San Francisco Estuary, with a focus on the following listed plant and terrestrial species: *Cirsium hydrophilum* var. *hydrophilum* (Suisun thistle), *Cordylanthus mollis* ssp. *Mollis* (soft bird's beak), *Suaeda californica* (California sea-blite), California clapper rail (*Rallus longirostris obsoletus*), and salt marsh harvest mouse (*Reithrodontomys raviventris*). The Tidal Marsh Recovery Implementation Team (RIT) was formed in 2015 and has been meeting quarterly. Restoration efforts from this plan are identified in its implementation table online at: [https://www.fws.gov/sfbaydelta/es/tidal\\_marsh\\_recovery.htm](https://www.fws.gov/sfbaydelta/es/tidal_marsh_recovery.htm). The RIT is working collaboratively with the San Francisco Bay Joint Venture and other partners to prioritize science, research, and restoration needs. The RIT is also currently developing an action item system by soliciting priorities by species from the clapper rail, salt marsh harvest mouse and plants groups to be presented at the next San Francisco Bay Joint Venture Conservation Delivery Committee meeting. This updated priority list will be used to leverage funding from traditional sources and Measure AA funding. A portion of tidal marsh restoration actions are to take place in the Suisun Marsh and Bay areas where the delta smelt resides (See Suisun Marsh Habitat Management, Preservation and Restoration Plan below). Actions taken are expected to have ecosystem-wide benefits and could positively impact delta smelt.

##### **Suisun Marsh Habitat Management, Preservation and Restoration Plan (The Suisun Marsh Plan)**

The Suisun Marsh Plan, signed in 2014, was developed to balance the goals and objectives of the Bay-Delta Program, Suisun Marsh Preservation Agreement and other management and

restoration programs within Suisun Marsh. The Suisun Marsh Plan provides for simultaneous protection and enhancement of Pacific Flyway and existing wildlife values in managed wetlands, endangered species recovery, and water quality. The plan's tidal wetland restoration program could benefit delta smelt via contribution to the Suisun Marsh food web. The first tidal marsh restoration project to fall under the Suisun Marsh Plan was the Tule Red Tidal Restoration Project that started interior construction in late fall of 2016. The project will convert approximately 420 acres of managed wetlands for waterfowl, by breaching a habitat berm allowing for tides to reclaim the land. The project is anticipated to breach in 2017. Once the breach has occurred, food web production is expected to be exported into Grizzly Bay where delta smelt are known to occur.

### **Ecosystem Restoration Program**

The State of California funds several initiatives to improve the estuary for fish and wildlife. The Ecosystem Restoration Program (ERP) was created to improve and increase aquatic and terrestrial habitats and ecological function in the Delta and its tributaries. Additionally, created in 2014, California EcoRestore Prop1 provides funding to facilitate regional water management while reducing reliance on water from the Delta. California EcoRestore also seeks to protect and restore important ecosystems.

The CDFW program seeks to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse plant and animal species. The Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) is one of four regional plans intended to implement the ERP. The DRERIP is an ongoing effort that has produced a series of conceptual models to inform agencies about processes, habitats, species, and stressors of the Bay-Delta ([http://www.dfg.ca.gov/ERP/conceptual\\_models.asp](http://www.dfg.ca.gov/ERP/conceptual_models.asp)). CDFW and the DWR are continuing to implement and plan for ecosystem restoration projects begun under the CALFED Bay-Delta Program located in Suisun Marsh, at Dutch Slough, at Cache Slough, in the Yolo Bypass, and at the Cosumnes River Preserve's North Delta project. Between 1994 and 2004, the program expended 700 million dollars on 500 restoration projects in the Estuary and its tributary rivers. This includes enhancement or restoration of over 19 miles of riparian and shaded riverine, instream riverine, saline emergent wetland and freshwater emergent wetland, and in-channel island habitat within the delta smelt's range. The program had also funded research on control and prevention of non-native species through the development of an ecological flow tool used to understand the relationship between flow and fish habitat needs in the Estuary. More information on the Ecosystem Restoration Program can be found online at: <http://www.dfg.ca.gov/erp/>.

### **California EcoRestore**

This initiative by the State of California is implemented in coordination with State and Federal agencies to advance the restoration of at least 30,000 acres of Sacramento-San Joaquin Delta (Delta) habitat by 2020. California EcoRestore will pursue habitat restoration projects including tidal wetlands, floodplain, upland, riparian, fish passage improvements and others. Planned restoration projects include the 8,000 acres of tidal habitat required under the 2008 Service BiOp.

To date, one tidal marsh restoration project has begun construction: the Tule Red Restoration Project, located in Suisun Marsh, which broke ground in September 2016. The project will restore 420 acres of managed wetlands into tidal and subtidal wetlands designed to provide food web benefits to delta smelt. In addition, Proposition 1 funds will be providing grant money towards ecosystem restoration and water quality improvement projects which may also benefit delta smelt. Although projects have been chosen to receive funding, no projects have been completed to date.

### **Habitat Conservation Plans and National Community Conservation Plans**

Under Section 10(a)(1)(B) of the Endangered Species Act, several Habitat Conservation Plans have been completed and are being implemented in the action area to provide long-term conservation planning in coordination with human development, while other Habitat Conservation Plans are still under development and in the planning stage. Of those completed, there is one that has delta smelt as a covered species. The San Joaquin County Multi-Species Habitat Conservation and Open Space Plan was completed in 2000. The HCP allows for urban development and includes compensatory mitigation for the loss of up to 371 acres of shallow water habitat and 3 acres of submerged aquatic habitat at a 3:1 ratio.

### **Conservation Banks**

The Service has approved two delta smelt conservation banks within the action area: North Delta Fish Conservation Bank and Liberty Island Conservation Bank.

#### *North Delta Fish Conservation Bank*

Wildlands worked in partnership with the landowners, The Trust for Public Land and Reclamation District 2093, to establish the 811-acre conservation bank located within the northern portion of Liberty Island and southern end of the Yolo Bypass. The conservation bank was approved in 2013 and will provide habitat benefits to delta smelt by enhancing 657 acres of tidal marsh wetlands, including emergent marsh, seasonal wetland, riparian, and shallow open water habitats, in addition to 68 acres of tidal channel enhancement, and over 32 acres of tidal emergent marsh creation through the removal of levees and lowering a portion of the existing floodplain habitat.

#### *Liberty Island Conservation Bank*

Liberty Island Conservation Bank is a 186-acre habitat restoration project in Yolo County, California. It is a mosaic of tidal aquatic habitats intended to benefit Delta native fish species, including delta smelt. The construction included creating open water channels, tidal emergent marsh, seasonally inundated floodplain habitats and removing levees which impeded tidal and flood flow. In all over 190,000 cubic yards of material was moved to complete the project. The conservation bank will preserve 19.3 acres of tidal channel in Liberty Cut and Shag Slough and restore or create 47.9 acres of emergent marsh and tidal channels for delta smelt.

## **Delta Smelt Resiliency Strategy**

The Delta Smelt Resiliency Strategy (Strategy) was proposed by the State of California in 2016. It proposes to address both immediate and longer term needs of the delta smelt, promote their resilience to drought as well as future variations in habitat conditions caused by climate change, future floods and droughts, CVP and SWP operations, and several other stressors. The proposed actions in the Strategy include habitat improvement projects like: aquatic weed control; north Delta food web adaptive management projects; outflow augmentation; reoperation of the Suisun Marsh Salinity Control Gates; sediment supplementation in the low-salinity zone; spawning habitat augmentation; Roaring River distribution system food production; and coordinated managed wetland flood and drain operations in Suisun Marsh. It proposes a variety of other actions intended to improve the status of delta smelt including cessation of salvage of nonnative fishes in the summer and fall; planning for improved stormwater discharge management; building the Rio Vista Research Station and Fish Technology Center; accelerating tidal marsh habitat restoration; and exploring the feasibility of restoring Franks Tract into a tidal marsh.

A subset of EcoRestore habitat restoration projects that overlap with the 8,000 acres of tidal marsh and associated subtidal habitat requirement previously described above in 2008 Service BiOp within RPA Component 4 is also described in the Strategy.

Of the actions proposed, the following action has occurred:

### *North Delta Food Web Adaptive Management Projects*

DWR augmented flow in the Yolo Bypass by closing Knights Landing Outfall Gates and routed water from Colusa Basin into Yolo Bypass in July 2016 to promote food production and export into areas where delta smelt are known to occur.

## **Summary of Environmental Baseline**

Much of the action area has been altered or degraded from its historical state. Loss of shallow water edge habitat along the Sacramento River and its tributaries has occurred over time from riprapping and will be likely maintained in the future. Loss and degradation of suitable habitat continues to pose the largest threat to delta smelt. Efforts by DWR and Reclamation are currently being made through the Delta Smelt Resiliency Strategy to improve baseline habitat conditions and therefore abundance of the population (DWR 2016). Other recovery actions include the future development of an estuarine research station and fish technology center.

Sources of injury/mortality to delta smelt and habitat loss include dredging, sand-mining, wastewater treatment plants, aquatic weed control, managed wetland activities, research and monitoring efforts, and small projects, such as boat docks. The Service has collaborated with other State, Federal, and private entities to significantly reduce monitoring and research efforts that result in lethal take in parallel with the observed change in status of the species. Although greatly reduced, existing monitoring and research programs still take delta smelt in the hundreds annually across all life stages. In addition to existing IEP monitoring efforts, additional efforts

are anticipated to continue into the near-term, such as the EDSM. Thus far, EDSM, as implemented, has taken considerably fewer delta smelt than originally estimated. The EDSM, for example, could greatly improve our understanding of the life history of the species, which will inform future conservation actions. The EDSM is also designed to inform CVP and SWP operations to minimize risk of entrainment.

### **9.2.2 Effects to Delta Smelt from the Proposed Action**

This BiOp includes a mixture of project- and program-level analyses for the different CWF components as described above. Preconstruction and construction-related activities have been analyzed and described in the CWF BA and supplemental documentation (*BiOp Resolution Log*) at the site-specific level for near-term implementation with no future Federal action required, except for the NDD, HORG, and CCWD settlement agreement facilities construction, which will have subsequent Federal approvals. The CWF BA supplemental material, provided to the Service on November 7, 2016, identified no in-water work and no effects to delta smelt and its critical habitat from the construction of the CCWD settlement agreement facilities. Effects to delta smelt and its critical habitat for all preconstruction and construction components of the PA have been analyzed herein at a project-level and include a jeopardy/adverse modification analysis; however, the ITS only includes take resulting from the preconstruction and construction components of the PA which will not have subsequent Federal approvals (*i.e.*, the NDD, HORG components, and CCWD settlement agreement facilities components are part of the framework programmatic action and are not included in the ITS). Effects to delta smelt and its critical habitat from operations of the new and existing CVP and SWP water facilities have been analyzed at a programmatic-level based on the framework programmatic approach of this consultation with a jeopardy/adverse modification analysis for dual conveyance operations. As described in Section 9.2.2.2, the ITS for delta smelt does not include take resulting from operations.

What has been referred to in Figure 9.2.2-1 as the NAA, No Action Alternative, has been provided to the Service in the CWF BA as a basis for comparison when discussing effects of implementing the PA, primarily for assessing effects from operations on delta smelt and its habitat. The NAA is intended to represent the projected conditions under existing regulatory requirements without the PA. The NAA is a representation of the base CVP and SWP operations and physical conditions at year 2030. The NAA and the PA simulations include assumptions about climate change including sea level rise, and water demands of a larger human population in California. Refer to CWF BA Appendix 5.A, *CalSim II Modeling and Results*, for more detail on the CalSim II modeling assumptions for the NAA and the PA. The NAA modeling does not fully represent baseline conditions, since only some of the components of the existing conditions were quantified in the computer simulations. Others are discussed qualitatively; for instance, the restoration of 8,000 acres of tidal marsh habitat identified in the 2008 Service BiOp RPA Habitat Component 4 that is required to be completed by 2018 was not directly simulated because the locations of most of the restoration have not been chosen. See *Status of the Species* for delta smelt and *Existing Conditions and Consultations in the Action Area* for more details.

The information presented here is based directly on CalSim II modeling that is described in the CWF BA Appendix 5.A, *CalSim II Modeling and Results*, sections 5.A.4.1 and 5.A.4.5. The

CalSim II model is a mathematical water planning tool developed by DWR and Reclamation. It estimates operational responses of the system, including CVP and SWP management, to variable hydrology on a monthly time step for an assumed level of development and an assumed regulatory environment using 82 years of historical data as model input (WYs 1922-2003). In a simple sense, the CalSim II model simulates how much water is stored and/or released from reservoirs and how much water is diverted and/or returned to the rivers, given a set of assumptions regarding infrastructure, demands and regulations. This series of steps is repeated one month at a time for 82 years, generating 82 years times 12 months equals 984 monthly estimates of any hydrologic quantity of interest. Thus, the model can produce very large amounts of information. The hundreds of graphical representations of CalSim II results in Appendix 5.A are but a small portion of the model's output.

Because CalSim II is a planning tool applied to hypothetical conditions, it is not intended to recreate the past. Rather, it is used to estimate what might happen in the future under specified conditions, *e.g.*, alternative water quality standards and other environmental regulations. The CalSim II model has been a standard part of CVP and SWP water operations consultations for more than a decade because it provides a way to quantitatively compare how things like reservoir storages, river flows, diversions from Central Valley rivers, Delta exports, and X2 locations are expected to vary given different sets of operating rules. In the BA, a proposed operational change (the PA) was compared to a simulation representing the existing regulatory regime (the NAA).

On page 5.A-6, the authors of Appendix 5.A noted that “The CalSim II model is most appropriately applied for comparing one alternative to another and drawing comparisons between the results.” However, CalSim II is a quantitative model that is not strictly a relative comparison model because the absolute values of outputs like exports, reservoir storages, OMR flows, and X2 locations are intended to at least approximate what the real-world conditions would be under a particular set of assumptions (CWF BA, Appendix 5.A, *CalSim II Modeling and Results*, page 5.A-12). This is reflected on page 5.A-5 of CWF BA Appendix 5.A, as the authors noted that “The ANN<sup>21</sup> [footnote inserted by the Service] is implemented in CalSim II to ensure the operations of upstream reservoirs and the Delta export pumps satisfy particular salinity requirements in the Delta.”

The Service was provided CalSim II output data and we generated graphs from those data for this BiOp. Some of our graphics plot the differences in X2 in the PA relative to the NAA. Some of our other graphics pick particular X2 and OMR values and compare the number of times the PA met that target relative to the NAA. We have used bar charts rather than continuous line charts to reflect CalSim II's discrete monthly time step. We have not relied on singular values (a particular month's results of an individual year) anywhere in the *Effects to Delta Smelt from the*

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<sup>21</sup> The ANN referred to in this sentence is an acronym for artificial neural network, a complex statistical tool that has been added to the CalSim II model to predict salinity in the Bay-Delta based on the model's flow predictions. See BA Appendix 5.A, CalSim II Modeling and Results section 5.A.4.1 for additional details.

*Proposed Action* or *Effects to Delta Smelt Critical Habitat from the Proposed Action* sections. Rather, we have limited our interpretation of the CalSim II results to trends that are obvious from visual inspection of the graphed data sets.

The Service has received various modeling outputs throughout the duration of the PA development. For the purposes of this BiOp, CalSim II modeling presented throughout the *Effects to Delta Smelt from the Proposed Action* and *Effects to Delta Smelt Critical Habitat from the Proposed Action* sections is based on data the Service received on May 5, 2017 of model runs dated April 28, 2017 (refer to *Consultation History* and CWF BA). However, the step-down analyses from CalSim II modeling using the Delta Simulation Model II (DSM2), such as DSM2-QUAL, DSM2-PTM, DSM2 hydraulic residence time, and DSM2 fingerprinting outputs, were derived using modeling runs dated April 8, 2015 for the NAA and June 1, 2015 for the PA (refer to *Consultation History* and CWF BA). The DSM2 outputs described above were provided to the Service from Reclamation, DWR, and the consultants in 2015, prior to PA modifications that occurred in late 2016 and early 2017, such as the enhanced longfin smelt outflow criteria, OMR October and November criteria modifications, and NDD RTO for post-pulse flow operations. In the *Effects to Delta Smelt from the Proposed Action*, *Effects to Habitat* section related to water temperature, turbidity, entrainment of food materials, *Microcystis*, and selenium, the analyses rely upon the 2015 DSM2 results. CalSim II and the subsequent step-down analyses were not modeled to capture future decisions during RTO based on fish presence for the NDD post-pulse protections.

The PA, as described in the *Description of the Proposed Action*, has been deconstructed into individual activities (Figure 9.2.2-1) and analyzed for effects to delta smelt.

## Section 7 Consultation for Federally Listed Fishes: Deconstruction of California WaterFix

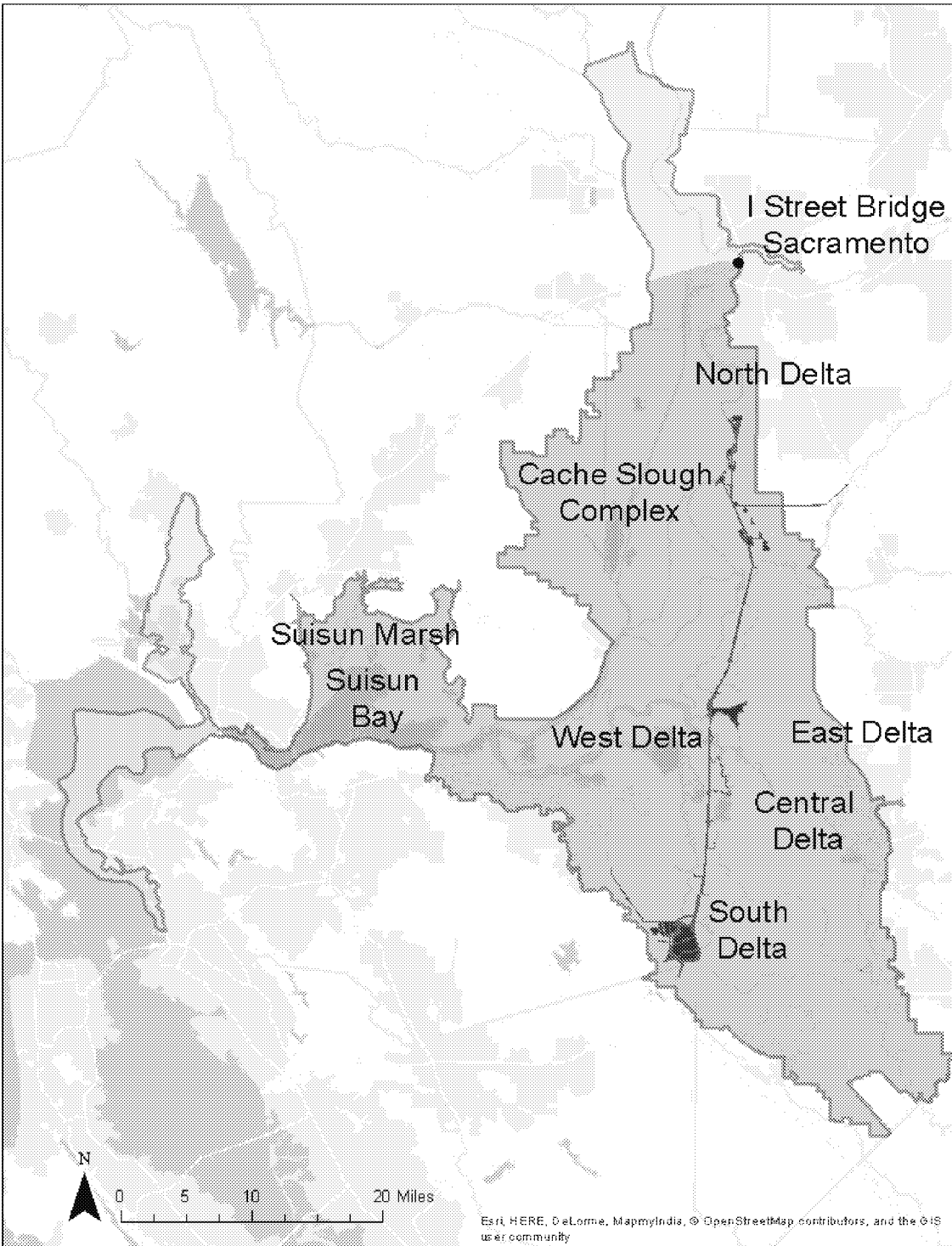


**Figure 9.2.2-1. Deconstruction of the existing and projected conditions (referred to as the NAA or No Action Alternative above) and PA (Proposed Action).**

#### 9.2.2.1 Preconstruction and Construction

Preconstruction activities include land-based and overwater geotechnical explorations. Construction activities are proposed to occur throughout the proposed footprint over 13 years (CWF BA Appendix 3.D *Assumed Construction Schedule for the Proposed Action*). Common construction-related activities among all water facilities construction include: clearing, site work, ground improvements, borrow fill, fill to flood height, dispose soils, dewatering, dredging and riprap placement, barge traffic, landscaping and associated activities, drilling, and pile driving. See Figure 9.2.2.1-2 below for the deconstruction.

Some components of the PA do not propose any in-water work (*e.g.*, land-based geotechnical explorations, temporary access and work areas, power supply and grid connections, and IF and conveyance tunnel construction). These components are judged to have no effect to delta smelt or its habitat, except in the event of an accidental spill or in the event where noise levels on land reach adverse levels to delta smelt. Effects to delta smelt and its habitat from accidental spills are addressed below. The remainder of the effects analysis is associated with components of the PA that include in-water work and noise effects. If the land-based components change as the PA is refined to include in-water work, reinitiation is required to analyze any new effects not analyzed in this opinion.



**Figure 9.2.2.1-1. Map of the CWF PA footprint (in red) in context to the delta smelt critical habitat (grey) and the range (light grey). The map provides general locations of surrounding geographical regions for orientation.**